इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”
Mazdoor Kisan Shakti Sangathan
“The Right to Information, The Right to Live”

“पुराने को छोड नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”

IS/IEC 61241-1 (2004): Electrical apparatus for use in the presence of combustible dust, Part 1: Protection by enclosures 'tD' [ETD 22: Electrical Apparatus for Explosive Atmosphere]

“ज्ञान से एक नये भारत का निर्माण”
Satyanarayan Gangaram Pitroda
“Invent a New India Using Knowledge”

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”
Bhartṛhari—Nītiśatakam
“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

IS/IEC.61241-1 : 2004
[Superseding IS 12315 (Part 1) : 1988]

भारतीय मानक

दहनशील धूल की उपस्थिति में प्रयोग होने वाले विद्युत के उपस्कर

भाग 1 "tD" आवेष्टन द्वारा सुरक्षा

Indian Standard

ELECTRICAL APPARATUS FOR USE IN THE PRESENCE OF COMBUSTIBLE DUST

PART 1 PROTECTION BY ENCLOSURES "tD"

ICS 29.260.20

©BIS 2009

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG NEW
DELH1110002

April 2009

Price Group 4

Electrical Apparatus for Explosive Atmospheres Sectional Committee, ETD 22

NATIONAL FOREWORD

This Indian Standard (Part 1) which is identical with IEC 61241-1 : 2004 Electrical apparatus for use in the presence of combustible dust — Part 1: Protection by enclosures "tD" issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Electrical Apparatus for Explosive Atmospheres Sectional Committee and approval of the Electrotechnical Division Council.

This standard supersedes IS 12315 (Part 1): 1988 'Methods of determining the minimum ignition temperature of dusts: Part 1 Dust layer on a heated surface at a constant temperature'.

The text of IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following;

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker in the International Standard while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to the following International Standard for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places are listed below along with their degree of equivalence for the editions indicated:

Internationa! Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 61241 -0 Electrical apparatus for use in the presence of combustible dust — Part 0: General requirements	IS/IEC 61241-0 : 2004 Electrical apparatus for use in the presence of combustible dust: Part 0 General requirements	Technically Equivalent
IEC 60529 : 2001 Degrees of protection provided by enclosures (IP Code)	IS 12063 : 1987 Classification of degrees of protection provided by enclosures of electrical equipment	do

Only the English language text has been retained while adopting it as an Indian Standard, and as such the page numbers given here are not the same as in the IEC standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS 2 :1960 'Rules for rounding off numerical values *{revised)'.* The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

INTRODUCTION

Many dusts which are generated, processed, handled and stored, are combustible. When ignited they can burn rapidly and with considerable explosive force if mixed with air in the appropriate proportions. It is often necessary to use electrical apparatus in locations where such combustible materials are present, and suitable precautions must therefore be taken to ensure that all such apparatus is adequately protected so as to reduce the likelihood of Ignition of the external explosive atmosphere. In electrical apparatus, potential ignition sources include electrical arcs and sparks, hot surfaces, and frictional sparks.

Areas where dusts, flyings and fibres in air occur in dangerous quantities are classified as hazardous and are divided into three zones according to the level of risk.

Generally, electrical safety is ensured by the implementation of one of two considerations, i.e. that electrical apparatus be located where reasonably practicable outside hazardous areas and that electrical apparatus be designed, installed and maintained in accordance with measures recommended for the area in which the apparatus is located.

Combustible dust can be ignited by electrical apparatus in several ways:

- by surfaces of the apparatus that are above the minimum ignition temperature of the dust concerned. The temperature at which a type of dust ignites is a function of the properties of the dust, whether the dust is in a cloud or layer, the thickness of the layer and the geometry of the heat source;

  by arcing or sparking of electrical parts such as switches, contacts, commutators, brushes or the like;
- by discharge of an accumulated electrostatic charge;
- by radiated energy (e.g. electromagnetic radiation);
- by mechanical sparking or frictional sparking or heating associated with the apparatus.

In order to avoid ignition hazards it is necessary that:

- the temperature of surfaces on which dust can be deposited, or which would be in contact with a dust cloud, is kept below the temperature limitation specified in this standard;
- any electrical sparking parts, or parts having a temperature above the temperature limit specified in IEC 61241-14:

    are contained in an enclosure which adequately prevents the ingress of dust, or
    - the energy of electrical circuits is limited so as to avoid arcs, sparks or temperatures capable of igniting combustible dust;
- any other ignition sources are avoided.

Compliance with this part of IEC 61241 will only provide the required level of safety if the electrical apparatus is operated within its rating and is installed and maintained according to the relevant codes of practice or requirements, for example in respect of protection against over-currents, internal short-circuits, and other electrical faults. In particular, it is essential that the severity and duration of an internal or external fault be limited to values that can be sustained by the electrical apparatus without damage.

Several techniques are available for the explosion protection of electrical apparatus in hazardous areas. This standard describes the safety features of these types of explosion protection techniques and specifies the installation procedures to be adopted. It is most important that the correct selection and installation procedures be followed to ensure the safe use of electrical apparatus in hazardous areas.

Two different types of practice, A and B, are specified in this standard and are intended to provide an equivalent level of protection.

Both of these practices are in common use and the requirements of each should be followed without mixing either the apparatus requirements and selection/installation requirements of the two practices. They adopt different methodology with the primary differences being:

Practice A	Practice B
Written principally as performance-based requirements	Written principally as prescriptive-based requirements
Maximum surface temperature is determined with 5 mm layer of dust and installation rules require 75 K margin between the surface temperature and ignition temperature of the particular dust	Maximum surface temperature is determined with 12,5 mm layer of dust and installation rules require 25 K margin between the surface temperature and ignition temperature of the particular dust
Method of determining dust ingress is according to I EC 60529 -IP Code	Method of determining dust ingress is in accordance with the heat cycling test

Indian Standard

ELECTRICAL APPARATUS FOR USE IN THE PRESENCE OF COMBUSTIBLE DUST

PART 1 PROTECTION BY ENCLOSURES "tD"

1 Scope

This part of IEC 61241 is applicable to electrical apparatus protected by enclosures and surface temperature limitation for use in areas where combustible dust may be present in quantities which could lead to a fire or explosion hazard. It specifies requirements for design, construction and testing of electrical apparatus.

This standard supplements the general requirements in IEC 61241-0.

NOTE IEC 61241-14 gives guidance on the selection and installation of the apparatus. Apparatus within the scope of this standard may also be subjected to additional requirements in other standards - for example, (EC 60079-0.

The ignition protection is based on the limitation of the maximum surface temperature of the enclosure and on other surfaces which could be in contact with dust and on the restriction of dust ingress into the enclosure by the use of "dust-tight" or "dust-protected" enclosures.

The application of electrical apparatus in atmospheres which may contain explosive gas as well as combustible dust, whether simultaneously or separately, requires additional protective measures.

Where the apparatus has to meet other environmental conditions, for example, protection against ingress of water and resistance to corrosion, additional methods of protection may be necessary. The method used should not adversely affect the integrity of the enclosure.

This standard does not apply to dusts of explosives which do not require atmospheric oxygen for combustion, or to pyrophoric substances.

This standard is not applicable to electrical apparatus intended for use in underground parts of mines as well as those parts of surface installations of such mines endangered by firedamp and/or combustible dust.

This standard does not take account of any risk due to an emission of flammable or toxic gas from the dust.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60529:2001, *Degrees of protection provided by enclosures (IP Code)*

IEC 61241-0, *Electrical apparatus for use in the presence of combustible dust - Part 0: General requirements* [5]

---

[5] To be published.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61241-0, as well as the following definitions, apply.

3.1

dust ignition protection type "tD"
all relevant measures specified in this standard (e.g. dust ingress protection and surface temperature limitation) applied to electrical apparatus protected by an enclosure to avoid ignition of a dust layer or cloud

4 Construction

In addition to the requirements of Clause 4 of IEC 61241-0, the following applies.

Apparatus for use in zone 20:

If the enclosure of the equipment is in accordance with the requirements of this standard, and all gaskets preventing the ingress of dust are not stressed by moving parts (e.g. shaft, operating rod), the enclosure is considered as infallible and the fault analysis is only applicable to the electrical circuit.

5 Practice A and practice B

Two different types of practice, A and B, are specified in this standard. Both are intended to provide an equivalent level of protection.

6 Supplementary requirements for electrical apparatus protected by enclosures for practice A for use in zones 20, 21 and 22

Dust-tight enclosures 1P6X shall be applied for use in:

- zone 20;
- zone 21;
- zone 22 with conductive dust.

Dust-protected enclosures IP5X shall be applied for use in:

- zone 22 with non-conductive dust.

At present, there are no additional requirements for practice A to those given in IEC 61241-0 and in this standard.

7 Supplementary requirements for electrical apparatus protected by enclosures for practice B for use in zone 20 or 21

7.1 Joints

7.1.1 Plain joints

Plain joints (see Figure 1) shall have a minimum contact width from inside to outside of the enclosure and a maximum allowable clearance between the surfaces as shown in Table 1.

Table 1 - Plain joints

Minimum contact width of the plain joint (mm), *W*	**5**	**22**
Maximum allowable clearance between the surfaces of the joint (mm), *G*	0,05	0,22
NOTE For widths of joints between 5 mm and 22 mm. the maximum clearance may be increased by 0,01 mm for each millimetre increase in joint width greater than 5 mm.		

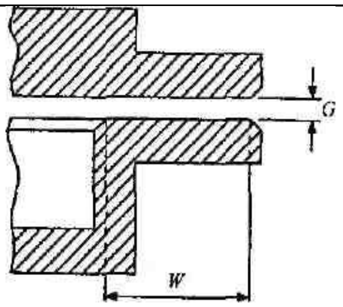

Figure 1 - Plain joints

7.1.2 Spigotted joints

Spigotted joints (see Figure 2), which have axial, *l,* and radial, *W,* paths neither of which is less than 1,2 mm, may have diametrical clearances as shown in Table 1 for plain joints. The radial section, *W,* of the spigotted joint shall have a maximum allowable clearance, *G,* as shown in Table 1 shown for plain joints.

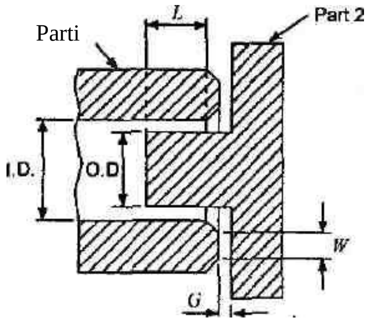

Figure 2 - Spigotted joints

7.1.3 Gasketed joints

For gasketed joints (see Figure 3), requirements are given in Table *2.*

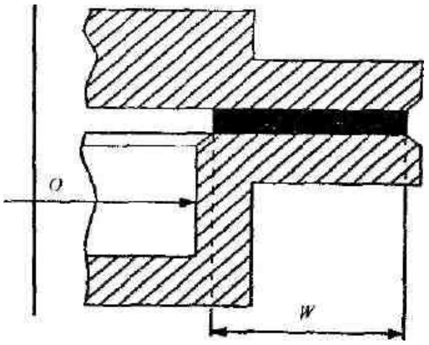

Figure 3 - Gasketed joints

Table 2 - Gasketed joints

Maximum opening dimension (mm), *0*	305	915	>915
Minimum required effective width of gasketed joint (mm), *w*	3	4,8	9,5

For maximum opening dimensions between 305 mm and 915 mm, the effective width of the gasketed joint shall be increased by 0,003 mm for each millimetre increase in the maximum opening dimension greater than 305 mm.

7.2 Operating rods, spindles or shafts

7.2.1 General

For apparatus intended for use in zone 20 and 21, dust exclusion shall not depend on running contact seals. The equipment shall meet the design details of Tables 3 and 4 and the tests of 8.2.1 without the running contact seal installed.

7.2.2 Running contact seals

If running contact seals are used, the equipment shall meet the design details of Tables 3 and 4 and the dust tests of 8.2.1 without the running contact seals installed.

7.2.3 Power shafts

Power shafts for transmitting power at rotational speeds of 100 r/min or more (see Figure 4), shall meet the requirements for the length of path from the inside to the outside of the enclosure as given in Table 3.

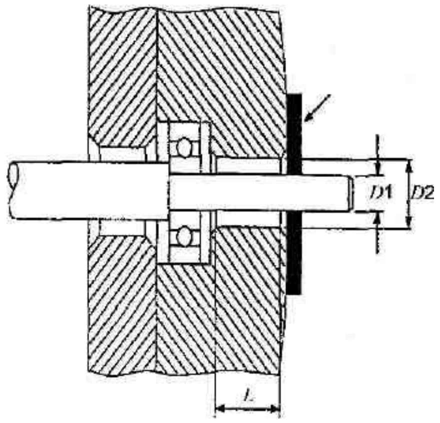

Figure 4 - Power shafts for speeds of 100r/min or more

Table 3 - Power shafts for speeds of 100 r/min or more

Minimum length of path for power shafts {mm), /,	12,5	38,5
Maximum allowable diametrical clearance (mm), D2 ~ /)1	0,26	0,57

For lengths of path for power shafts between 12,5 mm and 38,5 mm, the maximum diametrical clearance may be increased by 0,012 mm for each millimetre increase in the length of path greater than 12,5 mm.

NOTE The minimum length of path may include both the inner and outer lips of the bearing housing.

7.2.4 Operating rods

Operating rods, spindles or shafts having rotary motion of less than 100 r/min or axial motion, shall have either a threaded joint with three full threads engaging, or have a minimum length of path from the inside to the outside of the enclosure as given in Table 4.

Table **4** - **Power shafts for speeds of less than 100 r/min**

Minimum length of path for operating rods, spindles or shafts (mm), L	12.5	25,5
Maximum allowable diametrical clearance (mm), D2 - D1	0,13	0,21

For lengths of path for operating rods, spindles or shafts between 12,5 mm and 25,5 mm, the maximum diametrical clearance may be increased by 0,006 mm for each millimetre length of path greater than 12,5 mm.

7.3 Clearance of bolts

Bolts passing through the enclosure wall shall have a maximum diametrical clearance between the unthreaded shank of the bolt, A', and the clearance hole in the enclosure, *DS-DH,* of not more than 0,26 mm and a length of path, *L,* of not less than 12,5 mm (Figure 5).

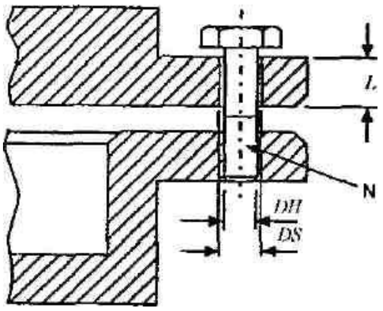

Figure 5 - Clearance of bolts

8 Verification and tests

8.1 General

In addition to the verification and testing requirements of IEC 61241-0, the following applies.

8.2 Type tests

8.2.1 Tests for dust exclusion by enclosures

8.2.1.1 General

Depending *on* the environmental conditions likely to be encountered (such as area classification and conductivity of dust) two levels of dust exclusion efficiency have been adopted: "dust-tight" and "dust-protected" enclosures.

NOTE For the required degree of dust exclusion efficiency, see IEC 61241-14.

In making an assessment for the acceptance of the apparatus following the tests, the effect of the presence of a combustible dust shall be taken into consideration.

The precautions that shall be taken where a combustible dust is used for the tests is left to the discretion of the testing authority or others concerned.

8.2.1.2 Dust-tight apparatus for practice A

Enclosures, including rotating machines, shall satisfy the requirements for IP6X, as specified in IEC 60529.

8.2.1.3 Dust-protected apparatus for practice A

All enclosures, including rotating machines, shall satisfy the test and acceptance requirements of IP5X, as specified in IEC 60529.

8.2.1.4 Dust-tight apparatus for practice B

8.2.1.4.1 Heat **cycling test**

a) The apparatus shall be mounted in a test chamber of sufficient size to permit free circulation of the dust-air mixture around the sample during the test.

   A mixture of suitable dust and air shall be circulated by auxiliary equipment and introduced continuously into the test chamber during the entire test period. The particle size of the dust shall be such that it passes through a No. 100 ASTM sieve (approximately 0,15 mm mesh width) with approximately 22 % passing through a No. 200 ASTM sieve (approximately 0,075 mm mesh width).

b) For the test specified above, the apparatus shall be operated at rated load until maximum temperatures are reached and then disconnected from the supply until it has cooled to approximately room temperature. The number of cycles of heating and cooling shall be at least six and shall last for a minimum of 30 h.

NOTE 1 The maximum temperature under load may be obtained by other means than running at rated load. For an enclosure such as a junction box without any appreciable heating effect (e.g. a switch), the effect of changes in barometric pressure may be simulated to produce the desired 'breathing" effect.

NOTE 2 Heating the chamber to 40 °C and maintaining this temperature for approximately 1 h and subsequently cooling the chamber to 20 "C and maintaining this temperature for 1 h has been found to be a satisfactory method for simulating changes in barometric pressure.

When the required number of heating and cooling cycles has been completed, the equipment for producing the dust-air atmosphere shall be shut off and the accumulated dust shall be removed from the exterior.surfaces of the enclosures by gently brushing, wiping or shaking, with care being taken to avoid the introduction of additional dust into the enclosures.

Under no circumstances shall the dust be removed by an air blast or by vacuum cleaning.

The' enclosure shall then be opened and carefully examined for the degree of dust penetration if any.

8.2.1.4.2 Acceptance criteria

No visible dust shall have entered the enclosure. Dust in joints shall not be considered a failure.

8.2.1.5 Dust protected apparatus for practice B

8.2.1.5.1 Heat cycling test

Proceed as described in 8.2.1.4.1 except the number of cycles of heating and cooling shall be at least two and for a minimum period of 10 h.

8.2.1.5.2 Acceptance criteria

No visible dust shall have entered the enclosure. Dust in joints shall not be considered a failure.

8.2.2 Thermal tests

8.2.2.1 Apparatus for practice A

This test shall be carried out as described in 23.4.5 of IEC 61241-0.

8.2.2.2 Apparatus for practice B

This test shall be carried out in accordance with 23.4.5.1 to 23.4.5.3 of IEC 61241-0 with the additional requirement that the apparatus shall be covered with the maximum amount of dust that it can retain. As an alternative, a 12.5 mm thick layer of dust paste may be put on top of the apparatus to simulate the build-up conditions.

NOTE The paste should consist of 45 % dust (e.g. wheat flour) and 55 % water by weight. The temperature value should be measured after the paste has dried.

9 Marking

Clause 29 of **IEC** 61241-0 applies except as follows:

29.2, item 4:

The symbol for the type of protection used shall be "tD" (protection by enclosure).

29.2, item 5:

The zone in which the apparatus can be used is prefixed by "A" for practice A and "B" for practice B.

29.2, item 6:

Practice B does not need to include the IP rating.

MGIPF—150 Deptt.of BIS C009—1 -8-2009—300Books.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act,* 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of the these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; **a** standard alongwith amendments is reaffirmed when such review indicates **that** no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc: No. ETD 22 (5900).

Amendments issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:
Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 Website: www.bis.org.in

Regional Offices:		Telephones
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	2323 7617 2323 3841
Eastern	: 1/14 C.I.T. Scheme VII M, VIP Road, Kankurgachi KOLKATA 700054	2337 8499, 2337 8561 2337 8626, 2337 9120
Northern	: SCO 335-336, Sector 34 A, CHANDIGARH 160022	260 3843 260 9285
Southern	: C.I.T. Campus, IV Cross Road, CHENNAI 600113	2254 1216, 2254 1442 2254 2519, 2254 2315
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400093	2832 9295, 2832 7858 2832 7891, 2832 7892

Branches : AHMEDABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. PARWANOO. PATNA. PUNE, RAJKOT.THIRUVANANTHAPURAM. VISAKHAPATNAM.

Printed by the Manager, Govt, of India Press, Faridabad